

Laparoscopic Management of Gallstone Ileus

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ABSTRACT

Gallstone ileus is an uncommon entity that was first described by Bartholin in 1654. Despite advances in perioperative care, morbidity and mortality remain high in patients with gallstone ileus because: 1) they are geriatric patients; 2) they often have multiple comorbidities; 3) presentation to the hospital is delayed; 4) many are volume depleted with electrolyte abnormalities; and 5) the diagnosis of gallstone ileus is difficult to make. Traditional management has entailed open laparotomy with relief of intestinal obstruction by enterotomy and stone extraction. Cholecystectomy and takedown of the cholecystoenteric fistula can be performed.

We propose an alternative method of management in an attempt to limit operative trauma and improve morbidity and mortality. We review the literature and describe two patients with gallstone ileus who were managed laparoscopically. One patient underwent laparoscopic assisted enterolithotomy, and the other patient underwent diagnostic laparoscopy with disimpaction of the gallstone into the large bowel. They were discharged after their ileus had resolved on the fourth and sixth postoperative day, respectively.

Laparoscopy is a powerful diagnostic and therapeutic tool that can be effectively used to treat gallstone ileus.

Key Words: Gallstone ileus, Laparoscopy, Bowel obstruction, Cholecystoenteric fistula.

INTRODUCTION

Gallstone ileus is a surgical emergency defined as a mechanical obstruction caused by intraluminal impaction of one or more gallstones anywhere between the stomach and rectum. The gallstone gains access to the intestine through a biliary enteric fistula that results from recurrent cholecystitis. Eighty percent of the time, the gallstone is passed uneventfully.¹ Generally, the stone must be greater than 2 cm in size to cause obstruction.²⁻⁴ The ileum is the most common site of stone impaction (60.5%) followed by the jejunum (16.1%), stomach (14.2%), colon (4.1%), and duodenum (3.5%).⁵ Gastric outlet obstruction caused by a gallstone impacted in the duodenal bulb is referred to as Bouveret's syndrome. The incidence of gallstone ileus in the general population is rare, accounting for only 1% to 4% of cases of small bowel obstruction.^{2,6,7} It is a disease of the elderly and accounts for 25% of cases of nonstrangulating, small bowel obstruction in those over 65 years of age.⁵ Females are more often affected than are males with a reported ratio of females-to-males between 3:1 and 16:1.⁵ A history of biliary symptoms is present in only 50% to 60% of patients.^{3,8,9}

Currently, the standard of care is open surgical intervention. Despite advances in perioperative care since the first review by Courvoisier in 1890,¹⁰ the morbidity and mortality of gallstone ileus remain high. Because of this, controversy exists over whether the cholecystoenteric fistula should be managed at the same time as the enterolithotomy (one stage procedure), or as a delayed operation, or not performed at all. A review of the international literature by Reisner and Cohen in 1994⁵ demonstrated a mortality rate of 11.7% for patients undergoing enterolithotomy alone and 16.9% for those patients undergoing a single stage procedure ($P < 0.17$). In those undergoing enterolithotomy alone, these authors reported a 15% incidence of symptomatic biliary tract disease and a 6% recurrence rate. The high morbidity and mortality rate in patients with gallstone ileus is attributed to patients' advanced age, associated comorbidities, and delay in diagnosis. In an attempt to limit operative time and surgical trauma, many authors now advocate simple enterolithotomy as the procedure of choice.^{2,4,6,11-15}

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Laparoscopy is a powerful diagnostic and therapeutic tool. Currently, three reports exist in the international literature regarding laparoscopic management of gallstone ileus.¹⁶⁻¹⁸ We describe two patients here and provide a review of the literature. One patient underwent diagnostic laparoscopy and laparoscopic assisted enterolithotomy, and in the second patient, the gallstone was manipulated into the colon with decompression of the obstruction. Cholecystectomy and repair of the cholecystoenteric fistula were not attempted in either patient as simple enterolithotomy alone is effective and associated with a low risk of recurrence.

CASE REPORT 1

An 86-year-old woman presented with a 2-day history of progressively worsening abdominal pain associated with nausea and vomiting. Her past medical history was significant for hypertension, non-insulin-dependent diabetes mellitus, and a total abdominal hysterectomy for uterine fibroids. On examination, she was afebrile and normotensive with mild diffuse abdominal tenderness. Her white blood cell count (WBC) was 11.7 E9/L, and her electrolyte panel demonstrated hypokalemic, hypochloremic metabolic alkalosis (potassium 2.7 mmol/L, chloride 95 mmol/L, carbon dioxide 30 mmol/L, blood urea nitrogen 28 mg/dL, creatinine 0.9 mg/dL). Plain radiographs of the abdomen demonstrated air in the biliary tree and dilated loops of small bowel in the left upper quadrant suspicious for gallstone ileus (**Figure 1**). Computed tomography (CT) of the abdomen with intravenous (IV) contrast demonstrated pneumobilia and an obstructing mass in the proximal jejunum consistent with gallstone ileus. The patient was admitted and treated with nasogastric decompression and IV fluids. Electrolyte abnormalities were corrected.

The following morning, a small bowel series (SBS) with water-soluble contrast was obtained and demonstrated near complete obstruction of the proximal jejunum with a 7 x 5-cm mass (**Figure 2**) and reflux of contrast into the gallbladder and biliary tree. The patient was brought to the operative theatre and prophylactic intravenous antibiotic (cefotaxime, 1 gm) was administered on induction of general anesthesia. Diagnostic laparoscopy was performed through a 10-mm port at the umbilical site after creation of a pneumoperitoneum with a Veress needle. Multiple adhesions were present about the right upper quadrant between the liver, omentum, and anterior abdominal wall; however, no obvious acute inflammation

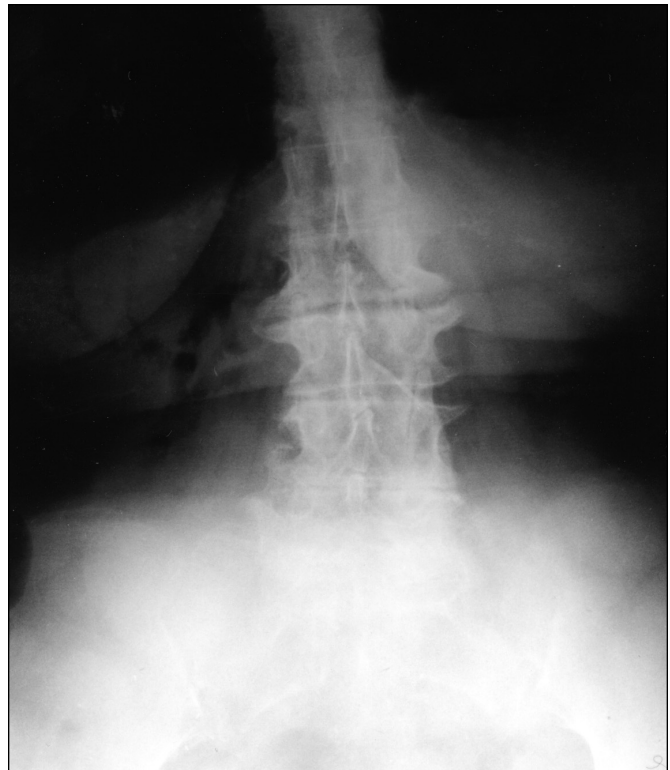


Figure 1. Plain abdominal radiograph of patient 1 demonstrates pneumobilia.

existed. No attempt was made to remove the gallbladder or the biliary-enteric fistula. The large bowel and majority of small bowel were nondilated. Additional 10-mm operating ports were placed in each of the four abdominal quadrants, and the small bowel was run using Babcock clamps in a hand-over-hand retrograde fashion. Trendelenburg and reverse-Trendelenburg positioning were used to facilitate exposure. The obstruction was identified in the proximal jejunum and was delivered through the left upper quadrant port site after the incision was lengthened transversely to 5 cm. A 6.3 x 4.5 x 4.2 cm smooth, oval stone was extracted through a transverse enterotomy (**Figure 3**), which was repaired in two layers. All port-site fascial incisions were closed. The patient was started on clear liquids on the third postoperative day after abatement of ileus. She was discharged home on the fourth postoperative day tolerating a regular diet. Follow-up at eight months demonstrated that she was asymptomatic.

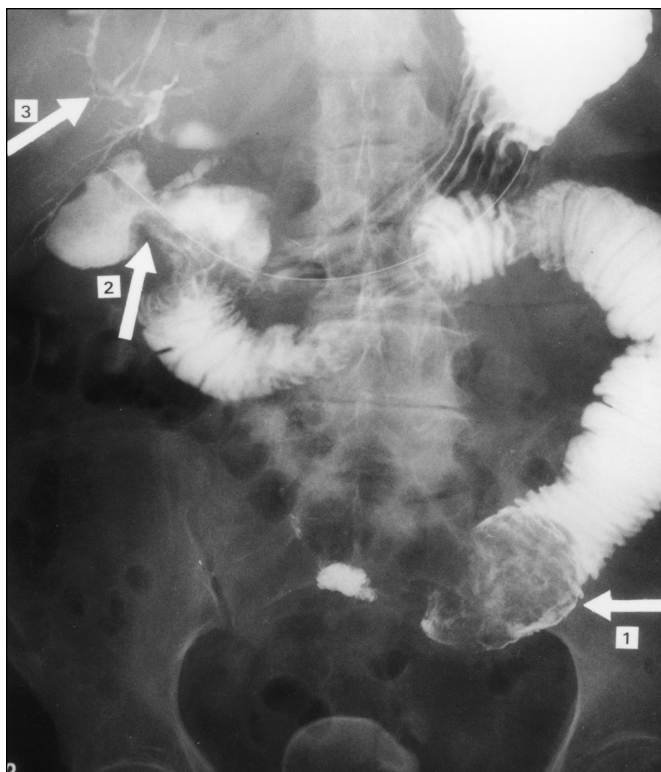


Figure 2. SBS of patient 1 demonstrates obstruction of the jejunum with a 7 x 5-cm mass (arrow 1) and reflux of contrast into the gallbladder (arrow 2) and biliary tree (arrow 3) via a cholecystoduodenal fistula.

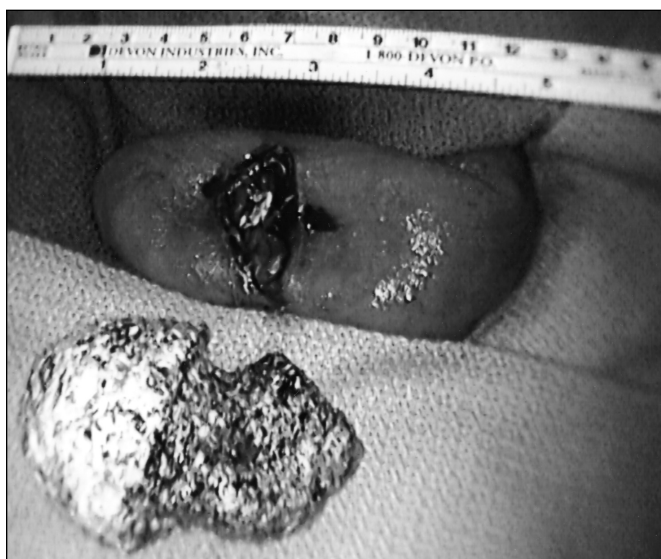


Figure 3. 6.3 x 4.5 x 4.2 cm gallstone extracted from the jejunum via a transverse enterotomy.

CASE REPORT 2

A previously healthy 76-year-old man with a 3-day history of abdominal pain, nausea, vomiting, and obstipation was transferred to the emergency department (ED) from an ambulatory care clinic. At the outlying facility, a nasogastric tube was placed, and 4,500 mL of bilious fluid were evacuated resulting in a significant relief of symptoms. On examination in the ED, the patient was hemodynamically stable and afebrile. His abdomen was mildly distended and nontender. Laboratory analysis demonstrated hyponatremia, hyponatremia, and azotemia (sodium 131 mmol/L, chloride 89 mmol/L, potassium 3.5 mmol/L, carbon dioxide 27 mmol/L, blood urea nitrogen 67 mg/dL, creatinine 1.8 mg/dL). The WBC count and differential, transaminases, and alkaline phosphatase levels were within normal limits. The plain radiographs were interpreted as being within normal limits. He was admitted with a diagnosis of a partial small bowel obstruction and was maintained nothing-by-mouth with nasogastric decompression. The electrolyte abnormalities were corrected, and he was volume resuscitated.

Computed tomography of the abdomen and pelvis demonstrated an oval-shaped, calcified mass near the terminal ileum with proximal small bowel dilatation (**Figure 4**). No pneumobilia was present. The diagnosis



Figure 4. Abdominal and pelvic CT of patient 2 demonstrates an oval-shaped, calcified mass obstructing the terminal ileum.

was unclear; therefore, a barium enema was performed the following day. This demonstrated a 5 x 3-cm stone within the terminal ileum. The patient was therefore diagnosed with gallstone ileus. The cardiac preoperative evaluation demonstrated preserved left ventricular function with no inducible ischemia. On the second hospital day, he was taken to the operative theatre. Prophylactic IV antibiotic (cefoxitin, 1 gm) was administered on induction of general anesthesia. Pneumoperitoneum was created using the Veress needle at the umbilicus, and diagnostic laparoscopy was performed through a 10-mm umbilical port. Omental adhesions to the right upper quadrant abdominal wall obscured the view of the liver and gallbladder. The entire small bowel was edematous and dilated. Three additional 10-mm ports were then placed under direct laparoscopic visualization in the left upper, left lower, and right lower quadrants. The gallstone could not be palpated within the ileum; therefore, the entire small bowel was run from the ligament of Treitz to the ileocecal valve in a methodical hand-over-hand technique using 10-mm Babcock clamps. The entire small bowel contents, including the gallstone, were decompressed into the colon without resistance. During manipulation, a 2-cm enterotomy was inadvertently made approximately 2 feet from the ileocecal valve. Minimal spillage occurred, and the small bowel opening was closed with 3-0 Vicryl suture placed laparoscopically in an interrupted fashion with an extracorporeal knot-tying technique. The entire peritoneal cavity was copiously irrigated with normal saline. No attempt was made to take down the cholecystoenteric fistula. Each of the four fascial incisions was approximated in figure-of-eight fashion using the Carter-Thomason instrument while maintaining pneumoperitoneum. The patient's hospital course was complicated with a community-acquired pneumonia that was identified on the admission CT and treated with the appropriate antibiotic, based on sputum culture sensitivities. The patient spontaneously passed the gallstone with a bowel movement on the second postoperative day. At this time, the nasogastric tube was removed, and the following day the patient was started on clear liquids. He was discharged home on the sixth postoperative day tolerating a regular diet. He was asymptomatic on follow-up at 4 months.

DISCUSSION

These two patients presented for treatment after having symptoms for several days, which is typical for gallstone

ileus. It is not uncommon, however, for the patient to present much later with intermittent obstructive symptomatology. This is referred to as the "tumbling phenomenon" and is thought to be due to the stone becoming lodged intermittently as it migrates through the intestine.⁵ A strong clinical suspicion is essential for making the diagnosis early. Rigler et al¹⁹ described diagnostic criteria based on plain radiographs: 1) pneumobilia; 2) intestinal obstruction; 3) aberrantly located gallstone; and 4) change in location of a previously observed stone. Balthazar and Schechter²⁰ added the finding of two adjacent fluid levels in the right upper quadrant representing air in the gallbladder and duodenal bulb. Unfortunately, these findings are not universal. When plain radiographs are equivocal, CT is useful in evaluating small bowel obstruction. For further investigation, CT and gastrointestinal contrast studies are complementary.²¹⁻²³ Ultrasonography is also useful in diagnosing gallstone ileus and is thought by some authors²⁴ to be superior to plain films. It can identify a diseased gallbladder, localize the stone or additional stones, and identify pneumobilia and the fistula.

In the first patient, gallstone ileus was suspected because of the findings on the plain films. The CT with IV contrast confirmed pneumobilia, the obstructing jejunal mass, and the cholecystoduodenal fistula. The electrolyte abnormalities were then corrected over the first 24 hours. The day after admission an SBS was obtained to determine a change in the location of the stone, and the patient was then brought to the operative theater. Certainly one could proceed with diagnostic laparoscopy after correction of the volume deficit and electrolyte abnormalities and forgo the CT and the SBS, as laparoscopy is an excellent diagnostic tool with therapeutic capabilities. In the second patient, the diagnosis was more illusive. Pneumobilia was not present on the plain films or the CT. The diagnosis was not made until the SBS confirmed the calcified mass to be within the terminal ileum excluding the differential diagnosis of an appendicolith.

At the time of the operation, after ensuring adequate IV access, we recommend securing the patient with the arms tucked at the side. This allows for extreme positioning of the surgical table, which serves to retract the viscera that in open procedures surgeons normally retract with their hand. It also avoids bumping the patient's arms into surrounding equipment during lateral table positioning and allows comfortable mobility of the

surgeon around the table. Side tables for the instruments are preferred as steep Trendelenburg positioning risks injury to the patient's lower extremities if they lie against the Mayo stand. Monitors are placed on each side at the head of the surgical table.

In the two patients presented, pneumoperitoneum was established at the umbilical site with the Veress²⁵ needle while maintaining upward retraction on the abdominal wall with towel clamps. This avoids injury to the viscera, and the puncture sites heal without noticeable scarring. In the markedly distended abdomen, an alternate access technique may be preferred. This can be performed using the Veress needle at either midclavicular, subcostal location followed by 5-mm port placement and exploration with the 5-mm laparoscope. The umbilical camera port may then be placed under direct visualization. Alternatively, the "open" Hassan technique can be used.²⁶

The procedure should not be limited by port placement. If necessary, operating ports can be placed in each of the four abdominal quadrants to allow access to the entire abdominal cavity. To effectively run the bowel, a two-handed technique is necessary. This is performed with a hand-over-hand method. Five-mm or 10-mm atraumatic bowel graspers can be used. Ten-mm Babcock instruments were used in our patients, as we have found their use to be less traumatic than the 5-mm graspers available in our institution. In the second patient, the small bowel was edematous and dilated. Despite gentle manipulation, an enterotomy was made. This opening however was easily repaired with intracorporeal and extracorporeal laparoscopic suture technique, and conversion to an open procedure was not necessary. Hand-assisted laparoscopy is another alternative. The hand, use of which may be less traumatic than use of laparoscopic instruments, can be used to localize the stone. The obstructed segment of bowel is delivered through this incision for enterolithotomy.

We chose to extend the left upper quadrant port site incision on the first patient and perform the enterolithotomy extracorporeally. This however can be performed entirely intracorporeally as demonstrated by Franklin¹⁷ who used an EndoGIA stapling device for closure of the enterotomy. Repair of the enterotomy can also be performed with laparoscopic suturing techniques. Large stones may be crushed inside a retrieval bag and removed through an existing port. Faceted or cylindrical stones have been

associated with the finding of additional stones and should prompt the search for other stones.²⁷

Management of the cholecystoenteric fistula remains controversial. In the two patients presented, the gallbladder with fistula was left in situ. Definitive management includes cholecystectomy and repair of the fistula coupled with enterotomy and removal of the obstructing stone. Proponents of performing enterolithotomy, cholecystectomy, and repair of the fistula as a one-stage operation^{4,7,9,28-31} contend that the source of future morbidity is eliminated. Recurrent pain, cholecystitis, cholangitis, gallstone ileus, gallbladder carcinoma, malabsorption, and weight loss are complications of cholecystoenteric fistulas. Advocates of performing enterolithotomy alone for the treatment of gallstone ileus point out that most of these patients are elderly with significant comorbidities. A prolonged operation, which may not be essential, is not in these patients' best interest. Cholecystoenteric fistulas are usually well tolerated and often close spontaneously. Moreover, cholecystectomy does not completely protect the patient from recurrent gallstone ileus as common bile duct stones have been reported to cause recurrent obstruction.⁵ If biliary tract symptoms recur, elective cholecystectomy and repair of the fistula can then be performed.^{2,4-6,11-15} Some authors advocate a one-stage operation in the low-risk patients and simple enterolithotomy in the high-risk patients.^{2,7,27,28,32-35} No randomized trial has been performed to address this controversy.

Wound infection is the most common postoperative morbidity in patients with gallstone ileus and has a reported incidence of 32%.⁵ Perioperative antibiotics have not lowered the rate of wound infection after open exploration according to some authors.³⁶ Others, however, have demonstrated that antibiotics significantly reduce the rate of wound infection.³ Each patient in this series received prophylactic intravenous antibiotic on induction of anesthesia, and neither patient developed a wound infection. No deaths and no identifiable postoperative morbidities occurred. Patient 2 had a community-acquired pneumonia, which was identified on admission and treated without sequelae. The patients were discharged on the fourth and sixth postoperative days. At follow-up, both patients were asymptomatic and in satisfactory condition.

This report and others demonstrate that laparoscopy can be effective in the diagnosis and treatment of gallstone

ileus. The entire small bowel can be methodically examined laparoscopically with a two-handed technique. Complications, such as the inadvertent enterotomy that we encountered, can be satisfactorily managed laparoscopically. Simple enterolithotomy or the "one-staged" operation as reported by Franklin et al¹⁷ and Sharma et al³⁷ can be performed successfully. The laparoscopic approach also inflicts less operative trauma on the patient, which may result in a shorter hospital stay and lower morbidity and mortality.

References:

1. Piedea OH, Wels PB. Spontaneous internal biliary fistula, obstructive and nonobstructive types: twenty-year review of 55 cases. *Ann Surg.* 1972;175:75-80.
2. Clavien PA, Richon J, Burgan S, Rohner A, Gallstone ileus. *Br J Surg.* 1990;77:737-742.
3. Deitz DM, Standage BA, Pinson CW, McConnell DB, Krippaehne WW. Improving the outcome in gallstone ileus. *Am J Surg.* 1986;151:572-576.
4. Kasahara Y, Umemura H, Shiraha S, Kuyama T, Sakata K, Kubota H. Gallstone ileus: review of 112 patients in the Japanese literature. *Am J Surg.* 1980;140:437-440.
5. Reisner RM, Cohen JR. Gallstone ileus: a review of 1001 reported cases. *Am Surg.* 1994;60:441-446.
6. van Hillo M, van der Vliet JA, Wiggers T, Obertop H, Terpstra OT, Greep JM. Gallstone obstruction in the intestine: an analysis of ten patients and review of the literature. *Surgery.* 1987;101:273-276.
7. Day EA, Marks C. Gallstone ileus. Review of the literature and presentation of thirty-four new cases. *Am J Surg.* 1975;129:552-558.
8. Raf L, Spangen L. Gallstone ileus. *Acta Chir Scand.* 1971;137:665-675.
9. Cooperman AM, Dickson ER, ReMine WH. Changing concepts in the surgical treatment of gallstone ileus: a review of 15 cases with emphasis on diagnosis and treatment. *Ann Surg.* 1968;167:377-383.
10. Courvoisier LT. Zsurstisch-statistische Beitrage zur Pathologie und Chirurgie der Gallenwege. Leipzig FCW Vogel, 1890.
11. Heuman R, Sjodahl R, Wetterfors J. Gallstone ileus: an analysis of 20 patients. *World J Surg.* 1980;4:595-598.
12. Syme RG. Management of gallstone ileus. *Can J Surg.* 1989;32:61-64.
13. Palomar de Luis M, Tubia Landaberea JJ, Elorza Orue JL. Fistulas biliodigestivas espontaneas. *Rev Esp Enferm Dig.* 1990;77:33-38.
14. Hildebrandt J, Herrmann U, Dietrich H. Der Gallensteinileus: ein Bericht uber 104 Beobachtungen. *Chirurgie.* 1990;61:392-395.
15. Rodriguez-Sanjuan JC, Casado F, Fernandez MJ, Morales DJ, Naranjo A. Cholecystectomy and fistula closure versus enterolithotomy alone in gallstone ileus. *Br J Surg.* 1997;84:634-637.
16. Montgomery A. Laparoscopic-guided enterolithotomy for gallstone ileus. *Surg Laparosc Endosc.* 1993;3:310-314.
17. Franklin ME Jr, Dorman JP, Schuessler WW. Laparoscopic treatment of gallstone ileus: a case report and review of the literature. *J Laparoendosc Surg.* 1994;4:265-272.
18. Sarli L, Pietra N, Costi R, Gobbi S. Gallstone ileus: laparoscopic-assisted enterolithotomy. *J Am Coll Surg.* 1998;186:370-371.
19. Rigler LG, Borman CN, Noble JF. Gallstone obstruction: pathogenesis and roentgen manifestations. *JAMA.* 1941;117:1753-1759.
20. Balthazar EJ, Schechter LS. Air in gallbladder: a frequent finding in gallstone ileus. *Am J Roentgenol.* 1978;131:219-222.
21. Taourel PG, Fabre J-M, Pradel JA, et al. Value of CT in the diagnosis and management of patients with suspected acute small-bowel obstruction. *Am J Roentgenol.* 1995;165:1187-1192.
22. Frager D, Medwid SW, Baer JW, Mollinelli B, Friedman M. CT of small-bowel obstruction: value in establishing the diagnosis and determining the degree and cause. *Am J Roentgenol.* 1994;162:37-41.
23. Swift SE, Spencer JA. Gallstone ileus: CT findings. *Clin Rad.* 1998;53:451-454.
24. Lasson A, Loren I, Nilsson A, Nirhov N, Nilsson P. Ultrasonography in gallstone ileus: a diagnostic challenge. *Eur J Surg.* 1995;161:259-263.
25. Veres J. Neus instrument zur ausfuhrung von brust-oder bauch-punktionen und pneumothoraxbehandlung. *Deut Med Wochenschr.* 1938;64:1480-481.
26. Hasson HM. A modified instrument and method for laparoscopy. *Am J Obstet Gynecol.* 1971;110:886-887.
27. Buetow GW, Glaubitz JP, Crompton RS. Recurrent gallstone ileus. *Surg.* 1963;54:716-724.
28. Berliner SD, Burson LC. One stage repair for cholecystoduodenal fistula and gallstone ileus. *Arch Surg.* 1965;90:313-316.
29. Warshaw AL, Bartlett MK. Choice of operation for gallstone intestinal obstruction. *Ann Surg.* 1966;164:1051-1055.
30. Fox PF. Planning the operation for cholecystoenteric fistula with gallstone ileus. *Surg Clin North Am.* 1970;50:93-102.
31. Van Landingham SB, Broders CW. Gallstone ileus. *Surg Clin North Am.* 1982;62:241-247.

32. Stull JR, Thomford NR. Biliary intestinal fistula. *Am J Surg.* 1970;120:27.
33. Duquesnay DR, De Paz H, Munroe L. Primary repair of the cholecystoenteric fistula in gallstone ileus. *West Indian Med J.* 1992;41:116-119.
34. Rubin M, Asseo G, Shimonov M, Pakula R, Mahagna Z, Antebi E. Management of gallstone ileus. A controversial issue. *Isr J Med Sci.* 1993;29:680.
35. Ozdemir A, Atli MY, Coskun T, Ozenc A, Hersek E. Biliary enteric Fistulas. *Int Surg.* 1997;82:280-283.
36. Kurtz RJ Heimann TM, Beck AR. Patterns of treatment of gallstone ileus over a 45-year period. *Am J Gastroenterol.* 1985;80:95-98.
37. Sharma A, Sullivan M, English H, Foley R. Laparoscopic repair of cholecystoduodenal fistulae. *Surg Laparosc Endosc.* 1994;4:433-435.